RESEARCH IN RURAL WATER SUPPLIES AND SANITATION

Michael G. McGarry

International Development Research Centre
Box 8500, Ottawa K1G 3H9
Canada

Paper presented to the Meeting of the World Health Organization
Research Study Group on Appropriate Technology for
the Improvement of Environmental Health
at the Village Level

16-20 October 1978
Delhi, India

RESEARCH IN RURAL WATER SUPPLIES AND SANITATION

This note is written for use at the October 1978 meeting of the Research Study Group on Appropriate Technology for the Improvement of Environmental Health at the Village Level held in New Delhi under the auspices of WHO's Regional Office for South East Asia. Its purpose is to briefly set out IDRC's activities in this sector and discuss some of the priority needs for research in the excreta/wastewater disposal and reuse sector.

The Health Sciences Division began funding rural water supply and sanitation (RWSS) projects in mid-1975, to date 44 projects are underway or are in the initial stages of receiving support. A complete list is attached hereto. The total amount of funds committed thus far are in the region of $4,000,000. IDRC's policy is to support developing country national institutions and researchers and in doing so to respond to their priorities. Research funding has been geared to both:

1. the maintenance of high standards in research; and
2. the development of research capability within the third world.

Of the several criteria placed on research supported by IDRC/HSD are:

1. that it should respond to national priorities;
2. that the project should be in a position to influence government policies and practices should research results merit implementation;
3. that the target population group which would ultimately benefit from the research be of the rural poor or the low income urban squatter settlements; and
4. that the investigators be committed to the research activity.

Efforts by international agencies to develop the rural water supply and sanitation sector as a whole are hindered by several constraints.

These include lack of such fundamental prerequisites as central government motivation and rational implementation policies. Financial and administrative infrastructure are inadequate and co-ordination between the responsible agencies is poor. Communications between government and villages being serviced are generally weak, resulting in misunderstandings and the early breakdown of the equipment installed through lack of maintenance and support at the local level. The selection of technology has been dominated by foreign consultants; equipment has been applied with inadequate attention being given to local conditions. Of particular note of this respect are village handpump and latrine installation programmes. Handpumps require maintenance; however, most installations have been made without adequate maintenance back-up facilities and in such a way that the community being serviced regards the pump as the property, and hence the responsibility, of the government.

RESEARCH PRIORITIES WITHIN IDRC'S FUNDING ACTIVITY

Due to constraints on funds and the lack of relevant research capacity in the field, it has been necessary to select specific research areas as foci which represent a compromise between those that are felt to exhibit the greatest promise and the constraints imposed by the limited research capacity. These are listed below; they are not in any order or priority:

1. Ground Water Extraction: studies on the development of handpump technologies which are relevant to local conditions and have potential for local manufacture.

2. Surface Water Treatment and Delivery: studies on low-cost, low-maintenance water treatment (clarification, filtration, disinfection) processes. This research is aimed at minimizing equipment requirements and reducing capital costs of existing water treatment plant designs for the larger villages and rural towns.

3. Wasteswater Management: investigations into alternative modes of excreta and wastewater collection and disposal in both the urban and rural contexts but with emphasis on the densely populated areas of the squatter settlements, where conditions are most critical and lack of feasible approaches most severely felt.

4. Wastes Reclamation: the development of reclamation systems aimed at the treatment and reuse of wastes (in particular, human excreta) which are applicable to those derived of the rural town and agricultural community. Specific emphasis is be given to the production of fish and other forms of biomass in waste treatment ponds and to health aspects related to such processes.

5. Impact of Water and Sanitation Interventions: investigations into the effects of water supply and sanitation delivery on the village. This work includes field studies of the impact on public health of various types and levels of improvements which can be made with a view to their optimization and definition of the most cost-effective combinations of interventions appropriate to the variety of village conditions in which they are to be made.

6. Social and Managerial Aspects: studies on the social, organizational, administrative and financial aspects of rural water supply programmes including traditional technologies and water-use practices; village organizational capacity and interaction with the government as related to water supplies; community participation and self-help approaches; the design of government administrative and financial infrastructure for implementation of rural water supply and sanitation schemes; and functions of the primary health care systems in maintaining installations and providing sanitary education.

7. Manpower Development: investigations related to the design of manpower development programmes, including training for rural water supply and sanitation. These will include studies on the role of village-level maintenance personnel, middle-level technicians, and the central co-ordination and design offices,

with a view to defining the type and number of personnel at each level required for effective back-up for the continued use, maintenance and extension of the systems, once installed.

Researchers who are interested in requesting support for work in this sector from the Health Sciences Division should initiate correspondence directly with the writer. Proposal development is very informal. The first letter should set out the proposed project in a few paragraphs. It is used to obtain an informal reaction from IDRC. This is followed by more detailed correspondence and most likely a visit by a representative of IDRC which will conclude with submittal of the formal proposal. The formal proposal will give details of the background to the proposal, the specific objectives of the work, how the research will be carried out, how the results are to be disseminated, how they might be utilized within the government's development activities, the budget and the way in which the funds are to be transferred and administered throughout the project. It is possible that the proposal will require some formal clearance by the recipient's government. Such clearances would be necessary prior to IDRC's formally accepting the proposal and committing funds.

RESEARCH IN EXCRETA AND WASTEWATER DISPOSAL

In the past, there has been a natural tendency to focus on the "hardware" aspects of technology for excreta and wastewater disposal. This has been in response to the technology gap between the objectionable pit privy and the too-expensive sewerage network system. Now that research projects in the developing countries are generating technical solutions more emphasis will have to be placed on the "software" components of development programmes in this sector.

Listed below are several techniques and technologies requiring further research. The list is obviously incomplete but could serve as a focus for discussion.

ON-SITE EXCRETA DISPOSAL TECHNOLOGIES

1. Lower cost construction methods and materials for all parts of the privies, compost and water seal latrines which will permit the owner to construct the unit himself without reliance on factory made parts.

2. Practical methods for reducing fly infestation and breeding within the pits and vaults.

3. Techniques for desludging the pit privy which are acceptable to the owner and which permits decentralization of responsibility for latrine maintenance.

4. Improved venting systems to reduce odours in the "dry" latrines and composting toilets.

5. Water using latrine designswhich encourage hygiene and handwashing in particular after defecation.

6. Techniques for reducing the quantities of water reaching the vaults of compost toilets.

7. Methods for reducing refuse and grass requirements of compost toilets while ensuring adequate temperatures are maintained within the compost development and field testing the Vietnamese double vault toilet in other regions and cultures.

EXCRETA COLLECTION TECHNOLOGIES

1. Low-cost yet functional designs and their field evaluation for vacuum trucks and vaults.

2. Minimum water use water seal riser seats for use with the household vault where squat plates are unacceptable.

3. Design criteria and field testing of the upgraded PRAI latrines connected to low sloped, shallow buried, small bore, low water use sewers.

4. Storm drain designs which will cope with sullage and other wastewaters which cannot be treated or adequately managed by the on-site excreta disposal technologies

5. Water use reducing devices and approaches.

EXCRETA TREATMENT AND REUSE

1. Field testing the Chinese and BARD systems of nightsoil composting with agricultural wastes and urban refuse.
2. Low-cost materials and construction designs for the biogas plant - such as the fixed top digester
3. Means by which digester temperatures can be raised and maintained during winter
4. More efficient gas burning devices (cookers and lamps) which can be fabricated within the village.
5. Improved operating regimes to raise the productivity of the biogas digester (gas/volabile solids introduced).
6. Use of excreta and sewage for aquaculture methods, increasing productivity including optimizing stocking rates, polyculture, algae production, culture of high yield, low quality varieties for fish meal and intensive aquaculture techniques.

The list is incomplete but illustrates the numerous opportunities and demands for research. There are even more solutions and information required in the non-technology areas.

Perhaps the most obvious questions centre around the health aspects of on-site disposal and reuse approaches. The transfer of pathogens through all the above processes need to be assessed. The spread of water related pathogens by introducing water coupled with excreta disposal technologies which cannot cope with sullage needs investigation. The potential for bioconcentration of pesticides and heavy metals through aquaculture reuse systems has not been quantitatively evaluated to date. Research which has been carried out in this area has tended to focus on pathogen transfer through the process itself and largely ignored their die-off or survival after harvest and through the market and food preparation processes.

Although costing exercises are relatively common little consideration has been given to the use of cost-effectiveness analysis to determine the overall least cost approaches from the national and user points of view. The householder's capacity to pay for or otherwise contribute to the technology and its maintenance remains a relatively untrodden area of research but is a crucial element in government programmes in this sector.

Institutional, manpower and management liminations remain as the greatest constraints on progress.

Manpower which is available for project implementation has been educated in sophisticated non-reuse technologies requiring excessive capital outlays. Manpower at the sub-professional levels is often non-existant and often needs to be trained on a project-by-project basis. There is an urgent need to transfer and adapt successful institutional and manpower development approaches from Latin America and Malawi for use in other regions and countries. What activity there is to counter this situation is still in its infancy. There remain urgent needs to develop relevant training programmes incorporating the lower cost technologies for manpower at all levels (professional, technician and village). There is however a dearth of innovative and evaluative capacities in the third world to meet these demands. Such capacities cannot be imported from abroad.

The lower cost technologies must be socially acceptable to the user. International agencies and even national governments are often ignorant of social factors in implementating their projects in their rural areas. It is often firmly stated that no reuse approaches would be acceptable to rural communities. Such broad-brushed negative reactions are often ill-informed. There are important examples of indigenous reuse practices such as the use of excreta in backyard fish production ponds in Indonesian Moslem communities. These point to the basic lack of understanding of motives and religious/aesthetic factors

of rural peoples' response to the reuse technologies.

Internationally assisted projects have a tendency to focus on the delivery of a technology to the rural village - most often a handpump or gravity fed pipe system. Technology is not enough. It needs to be introduced along with a change in hygiene habits in the home before its full benefits are realized. Latrines and sanitary education tend to fall way down on the list of priorities. This is a result of their being non-technology oriented, awkward and time consuming in implementation. Ways by which sanitary education and latrines can be more easily introduced with water as a "sanitation package" need to be developed and evaluated in the field. There remains a dearth of sanitation education material which focusses specifically on water and sanitation and can easily be implemented in the field.

Third world researchers in this field have tended to be divided and focussed on research acceptable for publication in the industrialized states. Practical means of encouraging communication between researchers in the developing countries without domination or control by international agencies need to be devised and implemented. Finally effective means of information transfer between developing countries has been lacking. Fortunately, the Asian Institute of Technology is establishing a Sanitation Information Centre which will be a first step in alleviating the situation.

Michael G. McGarry, Ph.D.,
Associate Director
Health Sciences Division
International Development Research Centre
P.O. Box 8500, Ottawa, Canada. K1G 3H9

IDRC FUNDED PROJECTS IN THE WATER SUPPLY AND SANITATION SECTOR

Groundwater Extraction

Manually Operated Low-Lift Pump Prototypes (Canada)
- University of Waterloo

Rural Water Technology Research (Canada)
- IDRC

Pump Windmill Systems (Canada)
- University of Waterloo

Pumping Technology Research (Ethiopia)
- Ethiopian Water Resources Authority

Windpower (Ethiopia)
- Ethiopian Water Resources Authority

Water Pumping Technology (Sri Lanka)
- Sarvodaya Shramadana Movement

Water Pumping Technology (Malaysia)
- University of Malaya

Shallow Well Pump Research (Malawi)
- Ministry of Finance - National Research Council

Water Pumping Technology (Kenya)
- Kano Water Development Trust

Water Pumping Technology (Thailand)
- Asian Institute of Technology

Water Pumping Technology (Philippines)
- University of Philippines

Windpower Pumping (Botswana)
- Rural Industries Promotions

Literature Review: Innovative Hand Pump Technology
- University of Waterloo

Water Treatment and Delivery

Water Treatment (Brazil)
- Campanhia de Saneamento do Parana/SANEPAR

Infiltration Galleries (Panama)
- University of Panama

Lapa Water Treatment Plant (Peru)
- Pan American Health Organization

Groundwater Iron Removal (Ghana)
- University of Science and Tehcnology

Wastes Management

Palm Oil Wastes (Malaysia)
- Asian Institute of Technology

Self-help Sanitation (Mozambique)
- Ministry of Public Works and Housing

Sanitation Technology (Zambia)
- National Housing Authority

Alternative Waste Disposal Phase II (Tanzania)
- Tanzania National Scientific Research Council

Environmental Health (Thailand)
- Applied Scientific Research Corporation of Thailand (ASRCT)

Alternative Waste Disposal Methods (Tanzania) Phase I
- Tanzania National Scientific Research Council

Squatter Settlement Sanitation (Botswana)
- Ministry of Local Government and Lands

Disposal of Human Excreta in Rural Areas (Ghana)
- University of Science and Technology

Piggery Waste Treatment (Singapore)
- Ministry of National Development

Reuse Wastes (Korea)
- Dong-A University

Excreta Reuse (Guatemala)
- Centro Misoamericano de Estudios sobre Tecnologia Apropiada (CEMAT)

Wastes Reclamation

Stabilization Ponds (Peru)
- CEPIS/PAHO

Waste Water Reclamation (Malaysia)
- University of Malaya

Waste Water Reclamation (Israel)
- Ministry of Agriculture

Waste Water Reclamation (Kenya)
- Ministry of Water Development

Waste Water Reclamation (Thailand)
- Asian Institute of Technology

Impact of Water and Sanitation Interventions

Gastro-enteritis (Guatemala)
- INCAP/PAHO

Water Impact (India)
- M.L.B. Medical College

Sanitation Impact (Bangladesh)
- Cholera Research Laboratory

Social and Managerial Aspects

Water Management (Nigeria)
- University of Ibadan

Maasai Water Impact (Kenya)
- University of Nairobi

Rural Water Supply (Korea)
- City College of Seoul

Water Management (Sudan)
- University of Khartoum

Gastro-enteric Diseases

Viral Gastro-enteritis (Caribbean)
- CAREC/PAHO

Rotavirus - INCAP (Guatemala)
- PAHO

General

Trust Fund Rural Water Supply and Sanitation
- World Health Organization

Handpump Lab Test (England)
- Consumer's Association